

Lecture 9: Entry and Incumbent Firms¹

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¹The lecture is based on [Belleflamme and Peitz, 2015] Chapter 16(Strategic Incumbents and Entry).

Entry and Market Structure

- ▶ So far, firms decisions we've studied have been pricing, advertising.
- ▶ These take the number and identity of competitors fixed.
- ▶ Probably, more important: enter/exit decisions.
- ▶ It is a dynamic decision: firm thinks about future and think about different possible scenarios.

Road Map

Entry and Market Structure

Entry Decision

Case Study: Uber v.s. Didi

Variable Profit: Business Stealing

Fixed cost

Incumbent Behavior

Deterrence

Accommodation

Predation

1. Theoretical Analysis
2. Types of Fixed/Sunk Costs
3. Uber vs. Didi
4. Article: The Determinants of Market Structure
5. Strategic Behavior and Deterrence

Market Structure: Questions

- ▶ Why does a market have only one, two, three firms? Why not more?
- ▶ When do firms enter/exit a market?
- ▶ Investment?
- ▶ These decisions are *dynamic*. Depend on expectations about future competition, rival's responses.
- ▶ Why are some industries concentrated? (E.g., cellphone carriers) Increasing returns, barriers to entry, efficiency differences?
- ▶ What would happen to prices (competition) if one more firm enters the market?
- ▶ How can incumbents respond to the *threat* of entry?

Market Structure: Determinants

- ▶ Market size
- ▶ Production technology (minimum efficient scale, fixed or entry costs)
- ▶ Scale economies
- ▶ History (information, sequential vs simultaneous entry)

Entry Decision

- ▶ Suppose market of size M , quantity competition.
- ▶ N firms in the market. Marginal costs = 0, *exogenous* fixed costs = F .
- ▶ Total demand is $Q = M - \alpha p$
- ▶ How many firms will there be in the market?
- ▶ I follow Mankiw and Whinston (1986)

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Two steps in the analysis:

- ▶ M potential entrants simultaneously choose whether to enter or not. If a firm enters, it incurs a sunk cost F .
- ▶ Entrants compete (e.g., in prices or quantities).

Entry Decision: 2nd Stage

Cournot competition (assume for now N exogenous)

- ▶ $\pi = qp(Q) - F$
- ▶ Firms are symmetric
- ▶ $q = M/(N + 1), Q = MN/(N + 1)$
- ▶ $p = \frac{M}{\alpha(N+1)}$
- ▶ $\pi = \frac{M^2}{\alpha(N+1)^2} - F$

Entry Decision: 1st Stage

Proposition: A firm will enter a market if profits are positive, and a firm will exit if profits are negative.

- ▶ $\pi(N) \geq 0 \Leftrightarrow \frac{M^2}{\alpha(N+1)^2} \geq F$
- ▶ $\pi(N+1) \leq 0 \Leftrightarrow \frac{M^2}{\alpha(N+2)^2} \leq F$
- ▶ Suppose $M = 1$, $\alpha = 0.1$, $F = 0.5$.

Then,

N	$\pi(N)$
1	2
2	0.611
3	0.125
4	-0.1

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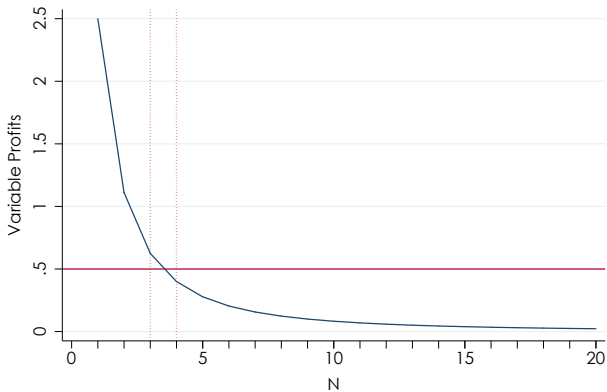
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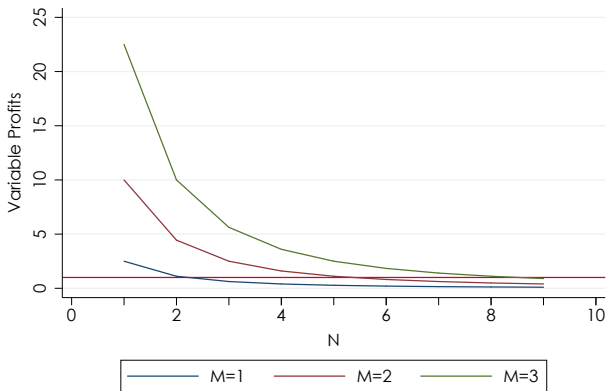
Predation



$M = 1, F = 0.5$. What happens in entry costs are higher?

Market Growth

What happens if market grows?



$$F = 1.$$

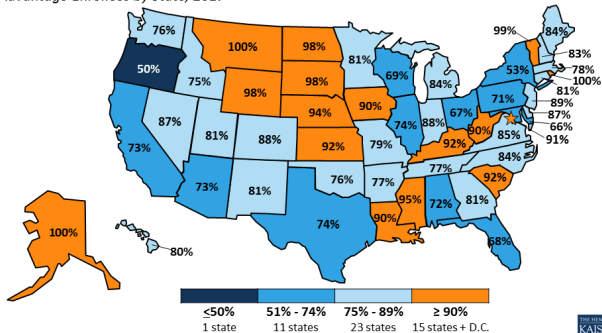
Caveats

- ▶ We saw $M \uparrow, N \uparrow$
- ▶ However, many markets have the same number of firms regardless of size. (e.g., mobile operators)
- ▶ Why? “Exogenous” fixed costs

Figure 7

In most states, three firms or affiliates account for more than three-quarters of Medicare Advantage enrollment

Combined Market Share of the Three Firms or Affiliates with the Largest Number of Medicare Advantage Enrollees by State, 2017



SOURCE: Authors' analysis of CMS State/County Market Penetration Files, 2017.



Source: Jacobson et al. Medicare Advantage 2017 Spotlight: Enrollment Market Update. Kaiser Family Foundation. June 2017.

Entry Decision: Takeaways

- ▶ If entry is costly, firms will enter until they earn profits close to zero.
- ▶ This is inefficient! Why?

Entry Decision: Takeaways

- ▶ If entry is costly, firms will enter until they earn profits close to zero.
- ▶ This is inefficient! Why?
- ▶ Firms don't take into account others' fixed costs.
- ▶ In general, firms face two effects:
 - Business stealing: firms want to enter the market to *steal* market share from incumbents. Creates more entry.
 - More competition: an additional entrant lowers market price. Reduces number of entrants.

Case Study: Uber's (failure?) in China

Entry and Market Structure

Entry Decision

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Was there place for two ride sharing companies in China?

Source: thetechnews.com

1. Uber Enters

- ▶ 2012: Didi started operating in China
- ▶ 2013: Uber entered the market.
- ▶ Didi: “horrible app and service,” “You had to send a voice message [in Chinese] with your destination and sometimes since my accent wasn’t clear enough for the driver ” (Forbes.com)

2. Didi Kuaidi

- ▶ February 2015: the two major Uber competitors Didi Dache and Kuaidi Dache announced their merger
- ▶ Merged company called Didi Kuaidi.
- ▶ Didi Kuaidi are backed by Alibaba and Tencent, two of the major internet giants in China.
- ▶ Didi used WeChat's 750 million monthly active users platform.

3. Stocking Up

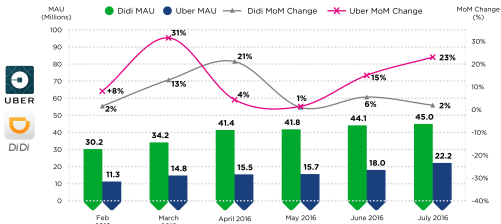
- ▶ September 2015: China's third major internet giant Baidu invested USD 1.2 billion in Uber.
- ▶ September 2015: Didi Kuaidi raised USD 3 billion from China Investment Corp., Capital International Private Equity Funds, and Ping An Ventures. Also, changed name to Didi Chuxing.
- ▶ May 2016: Apple invested another USD 1 billion in Didi Chuxing.
- ▶ By 2016, Didi Chuxing's app looks are very similar to Uber. Uber, slightly cheaper.

Why was big money so important?



DIDI & UBER MONTHLY ACTIVE USERS

MONTHLY ACTIVE USERS (M) | MONTH-ON-MONTH CHANGE (%) | FEB - JULY 2016 | CHINA



© Copyright Newzoo 2016 | Source: TalkingData Mobile Data Research Center



Source: thetechnews.com

4. Merger

- ▶ August 2016: Didi Chuxing acquires Uber's operations in China. Uber global will receive 5.89 % in the combined company \$35 bill. merger and 95% of the market
- ▶ In its China venture Uber reportedly spent \$2 billion in two years to win just 20% market share, and had yet to achieve profitability in a single Chinese city. (inc.com, CNBC)
- ▶ "Getting to profitability is the only way to build a sustainable business that can best serve Chinese riders, drivers and cities over the long term," Kalanick said.

Case Study: DKRX

Entry, Exit, and The Determinants of Market Structure.
Timothy Dunne, Shawn Klimek, and Mark J. Roberts,
Daniel Xu, Rand Journal of Economics, Fall, 2013

- ▶ Motivation: some markets are too small to have, say, a dentist. The (US) government provides subsidies to health professionals in this areas. This subsidy is equivalent to reducing entry costs.
- ▶ Question: are these subsidies justified? Do they work?
- ▶ Empirical issue: we don't observe entry costs!
- ▶ In addition, what can we know about competition if we observe N firms in the market? (Remember graph N vs. π .)

Case Study: DKRX

DKRX study dentists and chiropractors

- ▶ Subsidies to dentists: Health Professional Shortage Areas (HPSA), around \$60,000 for a full-time, two-year commitment. (Still, a lot of exit: the retention rate for dentists was 48 percent after 10 years.)
- ▶ HPSA markets: smaller, lower income.
- ▶ Services are standardized; one person firms (capacity limited).
- ▶ Dentists have much higher entry costs: specialized electrical, plumbing, and X-ray equipment. chiropractors need a table.

The authors use US Census data to estimate a model of entry.

TABLE 1 Demand and Market Structure Statistics (means across market-time observations)

Population Quartiles (mean population) ^a	Structure		Demand			Dynamics	
	<i>n</i>	Revenue per Practice ^b	Per-capita Income ^b	Fed. Medical Benefits ^b	Infant Mortality ^c	Entry Proportion	Exit Rate
			Dentist — non-HPSA Markets				
Q1 (5.14)	3.86	148.12	9.30	1.38	8.63	.204	.185
Q2 (7.67)	5.65	158.67	9.30	1.99	8.80	.206	.176
Q3 (11.10)	7.84	157.87	9.32	2.02	8.60	.206	.193
Q4 (19.93)	11.90	168.01	9.34	2.57	8.94	.209	.198
			Dentist — HPSA Markets				
Q1 (5.50)	3.92	129.11	9.12	1.30	9.12	.190	.214
Q2 (7.33)	4.57	148.62	9.13	1.51	9.13	.243	.212
Q3 (11.24)	5.16	151.27	9.18	1.47	9.18	.285	.208
Q4 (20.31)	8.55	171.99	9.17	2.02	9.17	.246	.175
			Chiropractors				
Q1 (6.39)	2.00	93.83	9.30	1.63	8.98	.413	.233
Q2 (9.74)	2.53	97.40	9.32	1.84	8.43	.482	.246
Q3 (14.92)	3.06	107.29	9.32	2.41	8.70	.503	.244
Q4 (28.20)	3.84	121.49	9.37	3.56	8.80	.518	.254

^athousands of people; ^bthousands of 1983 dollars; ^cdeaths per 1000 infants.

Entry-Exit Model

Entry and Market Structure

Entry Decision

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Variable Profit: Business Stealing

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Parts of the model:

- ▶ Short-run price competition: an increase in the number of firms in a market lowers the profits that are earned by all
- ▶ Fixed cost faced by producers, which is crucial to the exit decision of incumbent producers.
- ▶ Sunk entry cost faced by potential entrants.

What are these in the dentist-chiropractor context?

Entry-Exit Model: Incumbent

An **incumbent** firm decides to stay a market if present value of *future profits* are positive.

$$V = E \left[\pi + E_{\lambda'} (\max \{ \delta V' - \delta \lambda', 0 \}) \right]$$

- ▶ where V is the value of the firm, λ is the fixed cost of operation, λ' is the fixed cost of operation next period, and δ is the discount factor.
- ▶ Notice the maximum between future profits and 0. Why?

Entry-Exit Model: Entrant

A **potential entrant** firm decides to enter into a market if present value of *future profits* are positive, that is if:

$$\delta VE \geq \kappa$$

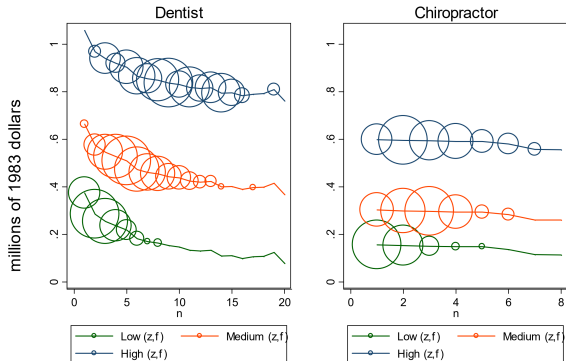
- ▶ where κ is the entrant cost, $VE = V'$, and V is the same term as before.
- ▶ Notice that V depends on the “state:” number of firms in the market and the market type (population size, income level, etc.)

How good are the model's predictions to those of the data?

TABLE 8 Average Number of Dental Establishments Per Market

z Category	non-HPSA Markets		HPSA Markets	
	Data	Model	Data	Model
1	3.83	3.80	4.13	4.35
2	4.75	4.36	4.29	4.31
3	4.89	5.03	4.71	4.36
4	5.85	5.66	4.79	4.27
5	6.07	5.96	5.25	5.05
6	7.03	6.85	4.58	5.11
7	7.89	7.40	5.63	5.71
8	8.93	8.24	8.71	7.28
9	10.27	9.52	9.17	8.61
10	13.18	11.72	13.09	11.94

The firms' present value.

Value of Continuation- $VC(n, z, f)$ 

Two differences: dentists' slope is more negative (more competitive market), higher firm value.

What is the effect of increasing entry costs of HPSA markets to that of non-HPSA ones?

TABLE 9 Reduction in Entry Cost: Impact on Entrants (percentage change in the variable)

Number of Firms	$VE(n, z, f)$			$p^e(n, z, f)$		
	Low (z, f)	Mid (z, f)	High (z, f)	Low (z, f)	Mid (z, f)	High (z, f)
$n = 1$	-5.83	-3.70	-2.10	20.30	15.88	11.87
$n = 2$	-5.60	-3.44	-1.89	21.90	16.79	12.38
$n = 3$	-5.97	-3.47	-1.84	23.12	17.51	12.79
$n = 4$	-5.84	-3.28	-1.70	24.53	18.23	13.17
$n = 5$	-6.09	-3.23	-1.63	25.80	18.89	13.52
$n = 7$	-5.86	-2.92	-1.41	28.44	20.06	14.10
$n = 9$	-5.62	-2.63	-1.22	31.15	21.11	14.59

Entry costs are 11 percent lower in markets that were designated as HPSA markets for dentists.

Table 9: Largest impact in the low profit markets. The subsidy aimed to increase the number of dentists in underserved markets. The results show that there are the most substantial percentage gains in low (z, f) (i.e., low profit) markets, not necessarily low n markets.”

What is the effect of increasing entry costs of HPSA markets to that of non-HPSA ones?

TABLE 10 Reduction in Entry Cost: Impact on Incumbent Establishments (percentage change in the variable)

Number of Firms	$VC(n, z, f)$			$p^*(n, z, f)$		
	Low (z, f)	Mid (z, f)	High (z, f)	Low (z, f)	Mid (z, f)	High (z, f)
$n = 1$	-6.50	-4.26	-2.50	7.85	9.11	8.99
$n = 2$	-6.26	-3.97	-2.26	6.64	7.89	7.76
$n = 3$	-6.50	-3.91	-2.15	5.93	7.18	7.05
$n = 4$	-6.36	-3.71	-1.98	5.20	6.44	6.31
$n = 5$	-6.62	-3.66	-1.90	4.73	5.97	5.84
$n = 7$	-6.31	-3.28	-1.63	3.69	4.91	4.78
$n = 9$	-6.06	-2.97	-1.42	2.92	4.13	4.01

Table 10: It shows that the lower entry costs lead to an increase in the exit rate, from 2.9 to 9.1 percent across states, with the largest percentage increase in firm exit coming in the highest profit markets, those with few firms and high (z, f) values. As expected, a reduction in entry costs acts to increase the competitive pressure from potential entrants, which results in both higher firm turnover and lower firm values.

Fixed or Entry Costs Subsidies?

Alternative policy to increase the number of dental practices:

- ▶ Subsidizing the costs of operating a practice in the market or provide additional payments to the practice based on the number of patients served.
- ▶ Equivalent to subsidizing fixed costs of everyone, not just entrants.

Fixed or Entry Costs Subsidies? (cont'd)

The two subsidies act in very different ways.

- ▶ The entry cost reduction increases the pressure from potential entrants, lowers firm values, and increases turnover, both entry and exit.
- ▶ The operating cost reduction makes it more profitable to be an incumbent, raises firm values, reduces exit, and leads to a small increase in entry.
- ▶ In both cases we simulate, the 11 percent reduction in entry cost and a 5 percent reduction in operating cost, [so that] the ultimate impact on market structure is very similar.

Fixed or Entry Costs Subsidies? (cont'd)

Entry subsidies encourage exit!

TABLE 11 Cost-Benefit Comparison of Alternative Policies

Impact on Market Structure	Benchmark non-HPSA costs	Entry Cost Reduction	Fixed Cost Reduction	Expand Program
$\Pr(n = 1)$	0.062	0.055	0.056	0.034
$\Pr(n \leq 3)$	0.338	0.313	0.319	0.246
$\Pr(n \leq 5)$	0.592	0.562	0.571	0.475
Average number of entrants/market	1.396	1.657	1.423	2.563
Average number of exits/market	1.029	1.131	0.950	1.477
Net change in establishments/market	0.367	0.526	0.473	1.086
Cost/additional entrant (millions 1983 \$)		0.103		0.075
Cost/additional establishment (millions 1983 \$)		0.170	0.503	0.140

Types of Fixed Costs: Exogenous

What type of fixed costs be chosen by the firms?

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Exogenous Fixed Costs

- ▶ Fixed size investments or investments that can only increase consumer utility for the product in a limited way.
- ▶ start-up costs, plant of minimum efficient scale, acquiring industry know-how.
- ▶ Main prediction: If market size grows, market becomes less concentrated (more firms)

Types of Fixed Costs: Endogenous

What type of fixed costs be chosen by the firms?

Endogenous Fixed Costs (Sutton and Shaked)

- ▶ Variable size investments the returns to which increase with market size
- ▶ Advertising, R&D, capacities.
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Failure to fragment follows from the fact that (under some conditions) market expansions lead existing firms to escalate their fixed costs. Instead of having more firms, larger markets have better products.

The central implication is that when fixed costs are determined endogenously, market structure is relatively invariant to changes in market size. It is fixed costs, rather than the number of firms, that increase with the scale of the market (Ellickson, 2007).

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Entry and Market Structure

Entry Decision

Case Study: Uber v.s. Didi

Variable Profit: Business Stealing

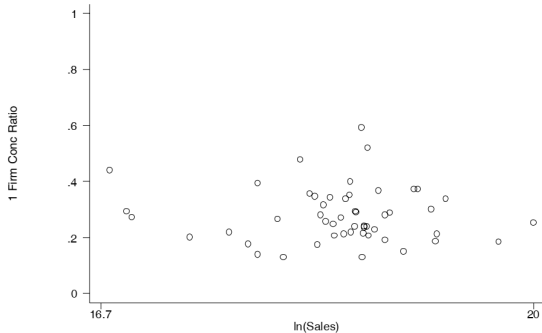
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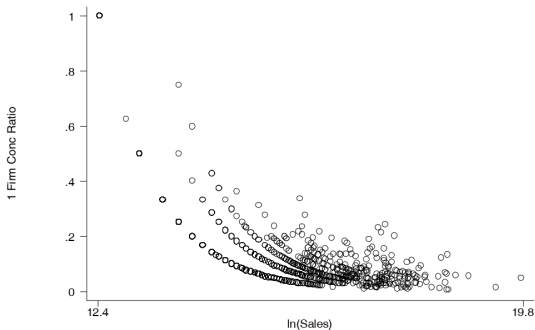
Predation



Supermarkets.

Source: Ellickson, Paul B. "Does Sutton apply to supermarkets?." The RAND Journal of Economics 38.1

(2007): 43-59.



Barber shops and Beauty Salons.

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Incumbent Behavior: Deterrence

What type of “fighting” strategies can the incumbent undertake?

Incumbent Behavior: Deterrence

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- ▶ Advertising

Incumbent Behavior: Deterrence

What type of “fighting” strategies can the incumbent undertake?

- ▶ Advertising
- ▶ Enlarge production capacity

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- ▶ Enlarge production capacity
- ▶ R&D

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- ▶ Predatory pricing (is it credible?)

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- ▶ Predatory pricing (is it credible?)

Why do these strategies work?

- ▶ Own/Rival's variable/fixed cost, demand?
- ▶ Commitment!
- ▶ Notice that incumbent needs monopoly power

Entry Deterrence

Lesson 16.1 If investment makes the incumbent *tough* (i.e., if investment decreases the entrant's profit), then the incumbent must behave as a *top dog* to deter entry: he must overinvest (be strong or big) to look aggressive. Conversely, if investment makes the incumbent *soft* (i.e., if investment increases the entrant's profit), then the incumbent must adopt a *lean and hungry look* to deter entry: he must underinvest (be weak or small) to look aggressive.

Acommodation

- ▶ Detering entry may happen to be too costly for the incumbent.
- ▶ In this case, incumbent firm takes entry as given
- ▶ Incumbent firm shifts its focus from the entrant's profits towards its own.
- ▶ Instead of it no longer chooses investments to make entrant's profit negative, the incumbent firm maximize its own profit.

Predation

Case Study: Morton, Fiona Scott. "Entry and predation: British shipping cartels 1879–1929." *Journal of Economics & Management Strategy* 6.4 (1997): 679-724.

- ▶ Why would you like to fight an entrant if you know everybody is going to lose?
- ▶ Chicago school: predatory pricing is unlikely to be profitable for a firm, and will therefore not occur.
- ▶ Example from shipping conferences (or cartels) in 1870-1900: associations of deep-sea merchant or passenger shipping lines. Different firms, all traveling same route.
- ▶ British lines were the largest and most technologically advanced, and were dominant in most trade routes during the period
- ▶ Question: Which entrant should you fight?

Conferences Routes

UK to Colonies in Asia and Africa

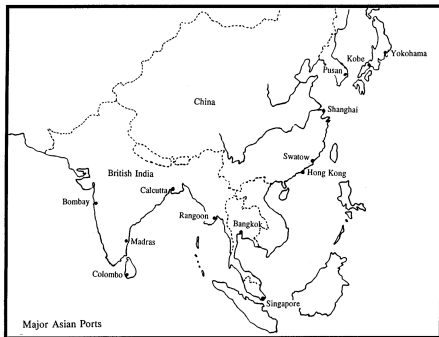


FIGURE 1.

Entry and Market Structure

Entry Decision

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What should the cartel do after entry?

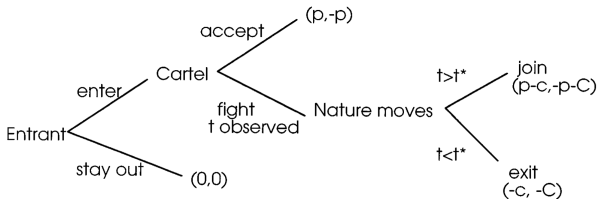


FIGURE 3.

Predation

*there is no room for the Strick Lines [in the market]
...We must repel his attack, and if continued we
should retaliate...*

Predation

*there is no room for the Strick Lines [in the market]
...We must repel his attack, and if continued we should retaliate...*

Still, they didn't fight every entrant:

TABLE II.
LOCATIONS OF PRICE WARS

Region	Entries	Price Wars
South Africa	24	7
India	12	4
Far East	11	3
Total	47	14

TABLE VI.
DETERMINANTS OF A PRICE WAR CONDITIONAL
UPON ENTRY

(A) Probit Specification^a

Variable	(1)	(2)	(3)
<u>New</u>	1.57** (0.762)	1.07 (0.883)	2.09** (1.23)
<u>Outside Opportunities</u>	-0.88** (0.049)	-0.080* (0.053)	-0.128** (0.065)
<u>Trade Growth</u>	-0.091** (0.044)	-0.093** (0.044)	-0.110** (0.056)
<u>Firm Tons</u>	-0.180* (0.117)	-0.210 (0.153)	-0.226** (0.133)
<i>Firm Tons 1q—dummy</i>	-1.18 (1.20)	-1.30 (1.36)	-1.51 (1.52)
<i>Firm Tons 2q—dummy</i>	-2.74** (1.19)	-3.31** (1.41)	-3.52** (1.63)
<i>Route Tons if lowest quartile</i>	0.987 (1.11)	0.698 (1.19)	0.868 (1.51)
<i>Route Tons if second quartile</i>	0.778 (0.608)	0.909* (0.634)	0.321 (0.807)
<i>Route Tons if third quartile</i>	0.480 (0.445)	0.395 (0.453)	0.305 (0.528)
<i>Route Tons if highest quartile</i>	0.089 (0.133)	0.072 (0.148)	-0.017 (0.163)
<i>Time</i>	0.047* (0.032)	0.068** (0.039)	0.006 (0.056)
<i>Contract</i>	—	0.925 (0.843)	—
<i>Subsidy</i>	—	-0.514 (0.734)	—
<i>Time since Last War</i>	—	—	0.038 (0.092)
Constant	-0.711 (1.53)	-0.551 (1.72)	1.03 (2.04)
$\Phi(X\beta)$	0.230	0.197	0.190
Observations	47	47	36
Log likelihood	-16.42	-15.52	-11.63

Entry and Market Structure

Entry Decision

Case Study: Uber v.s. Didi

Variable Profit: Business Stealing

Fixed cost

Incumbent Behavior

Deterrence

Accommodation

Predation

References I



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